AGRICULTURAL ENGINEERING

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E. W. LEHMANN, President **RAYMOND OLNEY, Secretary-Treasurer**

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AGRICULTURAL ENGINEERING
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Forward, Agricultural Engineers!

The President's Annual Address before the Sixteenth Annual Meeting of the American Society of Agricultural Engineers

By A. J. R. Curtis

ANOTHER year of agricultural-engineering activity has passed, and although we recognize the American Society of Agricultural Engineers as a busy and forward-looking organization, we may pause for a short period at the opening of this the sixteenth annual meeting, to recall briefly some of the achievements and possibly the shortcomings of the year.

It is doubtful whether any technical organization anywhere has a wider, more complex or more fundamental field than that included in the scope of agricultural engineering. The diversity of our immediate objectives is very great; still all of these focus clearly on the one ultimate objective—the improvement and upbuilding of American agriculture.

Agriculture is the prime mover in the industrial life of the nation, and we as agricultural engineers are concerned with the mechanics of production, while the civil engineer and the mechanical engineer are occupied largely with the mechanics of distribution and fabrication. I can think of no more useful service to our country and no more valuable contribution to its future happiness and well being, than that of the agricultural engineer, if our job is well done. Agricultural engineering is in the ascendency.

A. J. R. CURTIS

The industries within our wide range of activity present an interesting and varied picture at the present time, and never have they challenged our best thought and effort as they do now. Agriculture, along with the rest, has suffered a series of convulsions coincident to fluctuating price levels, still draining the dregs of our post-war cup of woe. And it is almost paradoxial that in such an hour of obvious need for labor-saving and cost-reducing devices, there should come a reversion or a retrogression of cast-off methods, or at least indifference toward more advanced and more efficient methods so much needed. But present experience is preparing the ground for future progress by providing some good everyday examples of what should not be done; and when this experience shall have moved off into proper perspective, we may expect to see thought and action again headed resolutely in the right direction. The grain grower who dodges an expenditure of $500 for needed equipment but has $1000 for a pleasure automobile and half that sum per year for maintenance, furnishes as good an example as the dairyman who has a good silo but doesn't fill it because it is too much trouble. As agricultural engineers we must help to get these matters in better balance. Conditions were never more auspicious than at present for an intelligent survey of waste in agriculture, to which survey some preliminary thought already has been given.

In attempting to sketch briefly the year's activities in our Society, I would like to call your attention first of all to the accomplishment of notable research work. Mention of research is not placed first because volume justifies it, but rather to emphasize the primary need for and tremendous value of such work. Research uncovers truth and truth stimulates action. Since the results of research work cannot always be immediately perceived, there is an unmistakable tendency on the part of many of us to give it second place or relegate it to the unassigned future. Extensive and significant as our efforts have been, every one with his ear to the ground must admit that we have fallen far short of what is needed. Let us aim higher.

Riding the crest of general acclaim (which is due largely to the work of Secretary Hoover and others in popularizing with the masses the general idea of standardization) our standardization work has prospered and has contributed notably to the sum total accomplishment in this line. It is a hopeful sign to see many manufacturers quietly applying the principles of standardization to their own lines.

In the three great groups of A. S. A. E. activity—farm power and equipment, farm structures, and reclamation—substantial progress has been made. However, in the field of farm power and machinery I do not feel that we are doing all the Society should be able to do in helping to solve the many difficult and delicate problems, some of which have grown to quite serious magnitude. The Society has done its share in providing the machinery for action, but committee work must be more extensive and intensive, and more seriously and vigorously attended to by the individual members, upon whom the efficiency of committee action largely depends. Then too, there must be not only substantial cooperation of manufacturers with the committee, but the former must exhibit something of a give-and-take attitude toward each other. These observations are all made in

analysis rather than criticism.

Several of the committees dealing with farm power and equipment problems have accomplished a large volume of good work. Some of the information being immediately applicable to urgent needs in related industry.

The farm structures work of the Society has made excellent progress. Almost every committee of the Farm Structures Section has discovered fundamentals which their reports now make available. The need is for more structures research and investigation in the colleges. Such a subject as crop storage buildings, divisible into a dozen closely related subjects, offers tremendous possibilities for stopping huge wastage on the farm.

The reclamation field, in its various aspects, has received far greater attention than ever before, and in commenting on the good work done by, or cleared through, the Reclamation Section it may be well to emphasize the almost limitless possibilities for future activity in the fields of drainage, irrigation, land clearing and kindred lines. These will justify continued expansion of our reclamation work.

The College Section must continue to coordinate and amplify agricultural engineering work in the colleges. I would suggest that it go even further, and give thought and attention to developing a higher regard for agricultural engineering among administrators, teachers and students at these institutions. Some wag said "Toot your own horn—no one else will," and another, "Toot your own horn or you may not have one to toot." This spirit, modestly and appropriately evidenced, is not a bad thing.

This year we have had under close observation two instruments of Society work—the committee and the section. The more expanded and useful life which the American Society of Agricultural Engineers must lead in the future, requires more thoughtful and earnest work by committee members individually. Every individual member should be a continuous, vital factor. No man should accept appointment unless he intends to work hard.

Our experiment this year in organizing our committee work into logical sectional groups has worked out admirably, and in order to take care of the continuous expansion of our Society work, the section plan of organization should be continued and strengthened.

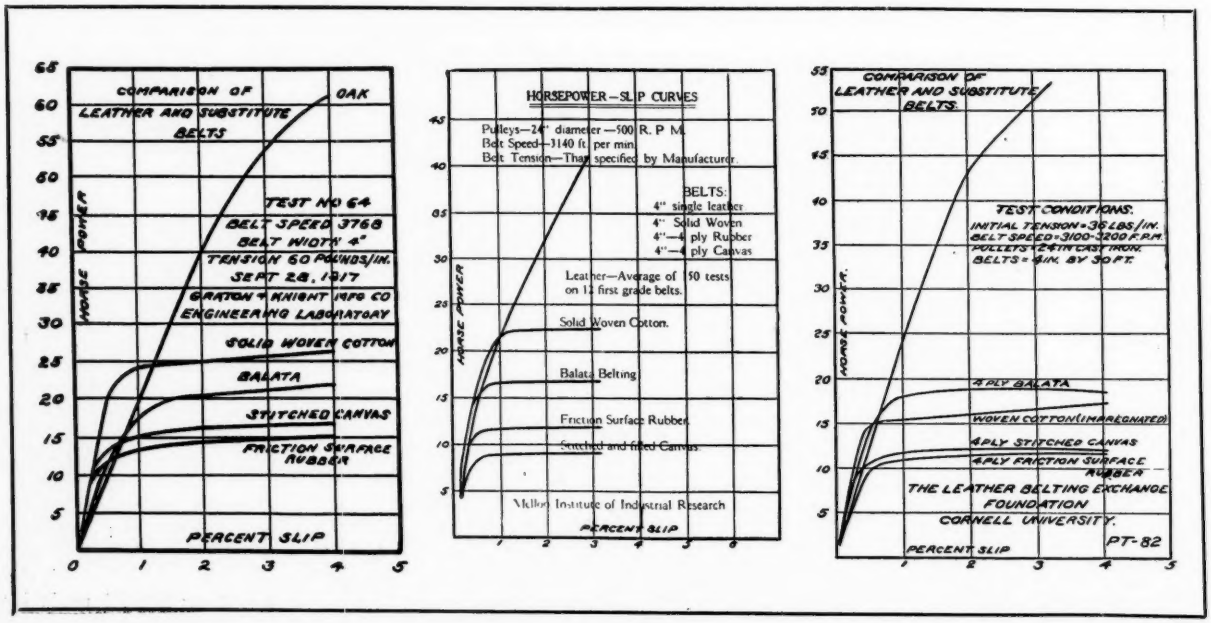
I am glad to testify, after a year's close contact and observation, that our Society is fundamentally sound in plan and in concept, efficiently organized, and, in short, a good machine for the purpose. During the year now closing, my intimate contact with so many keen and virile personalities, enthusiastic and well informed on so many phases of our great problems, has made me feel like an amateur in a great company of veterans and professionals. For loyal support and ready help, for kindly advice and service unselfishly rendered. I sincerely thank you all. No better wish can be extended to my successor than that the same bounteous support shall also be his.

Cost of Farm Storage of Wheat

THE KANSAS agricultural experiment station has just issued an interesting bulletin entitled "Farm Storage as a Factor in the Marketing of Wheat." In connection with the matter of cost of farm storage, while it was impossible to get accurate details on all the various items, estimates were secured on major items including interest on investment in granary or storage space, taxes, depreciation, insurance, labor used in binning and in loading out, loss of wheat in handling, and insurance on wheat in storage. For granaries built or purchased in 1919 and 1920, good wheat storage was, for the most part, secured at from 20 to 25 cents per bushel of capacity. The data shows that taking into consideration the foregoing major items, the cost per bushel per month of storing Kansas wheat in farm granaries, the average storage period being four months, was 1.7, 1.4, and 1.4 cents for the eastern, central, and western sections of Kansas, respectively. With the cost of storage space figured at 1913-1914 prices, instead of 1920 prices, the cost of storage would be reduced to approximately one cent a bushel a month.

A Correction

THROUGH an oversight in making up the December number of AGRICULTURAL ENGINEERING, the curves below were omitted. They are the horsepower-slip curves referred to in the article entitled "Relation of Leather Belting to Economical Power Transmission," by Claude O. Streeter, on page 200.



The Secretary's Annual Report

By Raymond Olney

THE FUTURE of the American Society of Agricultural Engineers is assured beyond question. It was no more than we could expect that the Society should feel keenly the effect of the depression through which the country has been passing, naturally so because of the fact that it is so closely allied to agriculture as well as the industries and professions directly dependent on agriculture. In a recent address Secretary of Agriculture Henry C. Wallace characterized it "the most severe agricultural depression the country has ever experienced." In spite of that fact, and also in comparison to some of the older and larger engineering societies, we are coming through the depression in remarkably fine shape.

Those of you who attended the annual meeting a year ago remember that at that time there was a deficit in our treasury in excess of $2000. The treasurer will not be able to make a complete report until after January 1, but from the records of the Secretary's office the financial statement for the year 1922 will probably show a balance to our credit.

Because of the outlook a year ago, the disposition of the Council was to go slow on expenditures during 1922. We have endeavored to be very frugal and do only those things which were absolutely necessary to keeping the Society on an even keel until we were sure of our course and the weather, particularly the weather.

The outlook at the present time is very much improved. With this in view, and also because of the improved financial condition of the Society, I believe the Council will approve a more aggressive policy for growth and expansion during 1923.

I am glad to report that we are now caught up on the publication of the Transactions. The 1920 Transactions were mailed to members in July, and the 1921 Transactions in November.

In spite of the conditions which have made it difficult to procure advertising for AGRICULTURAL ENGINEERING, the monthly journal of the Society, still it has been self-sustaining during the past year.

We have not had a great deal of difficulty in getting a sufficient amount of material for the Journal, especially in its present size, but we have had difficulty in getting a proper balance of material on the various phases of agricultural engineering. There has been more or less criticism from members on this score, but it must be remembered that until the size of the Journal is increased considerably it will be out of the question to get a balance of material that will suit everyone.

As pointed out at the meeting a year ago, the Journal was launched just prior to the depression, and, naturally, it has been a difficult matter to build up advertising patronage as fast as we would like to. We are in hopes, however, to increase the volume of advertising sufficiently this year to make possible the issuing of a larger publication. I have been connected with publications sufficiently to know that publishing has its problems as well as any other business, and our Journal is no different than any other publication in this respect. In spite of that fact, however, I feel that we have done remarkably well under the circumstances.

The Society has in its Journal a very valuable asset, and it is the duty of every member to support it in every possible way. We are handicapped to some extent because of the fact that the Society has no funds to pay for contributed material, but I believe that members who have good agricultural-engineering information and data that they are in a position to release for publication should give consideration first to AGRICULTURAL ENGINEERING.

Inasmuch as papers, discussions, and reports presented at professional meetings of the Society, or that portion having permanent engineering value, are published in the Transactions, it hardly seems consistent to publish them in full in the Journal. One reason why we have done it, however, is because we have not had a sufficient amount of original material to fill the columns of the Journal. The ideal way I believe would be merely to publish abstracts of papers and reports in the Journal, with the idea that the bulk of the Journal would be devoted to original articles.

The Council by resolution at one of its meetings earlier in the year approved the plan of printing original articles, appearing in the Journal and having a permanent engineering value, in the Transactions of the Society. This plan was followed out in the 1920 and 1921 Transactions. In this way each member will have in the Transactions all the material that the Publication Committee considers of permanent engineering value. It will not, however, include all the material that is published in the Journal, but will probably average about seventy-five per cent of it.

During the year two new student branches of the Society have been organized, one at Illinois and the other at North Carolina. Two others, at Mississippi and Virginia, are in the process of organization at the present time. We have had during the year several requests, for admission as student members, from students in agricultural engineering courses at institutions where the organization of a student branch is out of the question at the present time. This is a matter which requires our early attention, and I would recommend that some provision be made for the admission of such students to membership on a basis similar to other student branch members.

It would seem to me that the best source of new members for the Society is from the student branches, and I should like to urge upon the heads of the departments of agricultural engineering at the state institutions and their associates the idea of using their best efforts to encourage student branch members to apply for transfer to the junior grade of membership immediately upon graduation. A special campaign was conducted from the Secretary's office in May, June, and July of this year, and as a result quite a large number of transfers from the student to junior grade were made.

I should also like to urge upon the departments of agricultural engineering at the state colleges more attention to student branch activities; wherever possible there should be a student branch organized and plenty of stimulus provided to keep the branch active and the students interested. From the standpoint of your own work, I believe it would be very much worth while.

The membership situation is one which should have the earnest attention and help of every member of the Society during the coming year. It is only natural to expect that the depression we have been passing through would result in a large number of members resigning. We have not suffered as badly as some of the older societies in this respect, but bad enough.

During the past year we have received about one hundred resignations, and the addition of new members has not kept pace with the resignations. For the same reason that members found it necessary to resign, we have not been able to interest prospective members as we would under ordinary conditions. However, conditions are slowly but surely improving, and I believe that the time has come when we should launch an aggressive campaign for new members. A

membership committee will be appointed this year, which it is believed will get results, but this committee will be only partially effective if it does not have the active cooperation of the entire membership. We want each and every member to suggest the names of men who are eligible and who should be members of our organization.

Comparatively speaking, the Society is still young in years, as is also the agricultural-engineering profession. For that reason we have not acquired the momentum of some of the older engineering societies, and naturally we are more dependent on the cooperation and support of individual members and individual efforts than they are. At the same time I am convinced that this organization is sufficiently established so that its future is assured, and in spite of the difficulties encountered I feel we have made remarkably good progress and are in a good position at this time to go ahead with bigger accomplishments. From this time on watch A. S. A. E. go—and grow.

Aims and Objectives of the A. S. A. E. for 1923*

By E. W. Lehmann

WE HAVE an active, growing organization and I consider it an honor to be its president. However, I feel unprepared for the task that is before me and it is only through the whole hearted cooperation of its members that the Society will continue to prosper. In accepting the office of president I do not accept the entire responsibility for the future progress of the Society, the greater part of this responsibility is yours.

The first requirement for the success of an organization is faith in the organization by its membership. I believe the A. S. A. E. membership has this faith. This is evidenced by the present condition of our Society after a rather hard year. If we have any pessimists in our group our first move should be to make optimists out of them. If we have any knockers let us make boosters out of them. Let us have faith.

The second requirement for the success of any organization is active membership. We must be active to get results. Our committee men should be more active than in the past, and our committee chairmen have a special responsibility to the Society to produce results. Every member should also feel it his duty to contribute toward the work of one or more committees whether he be a committee member or not. It is easy to knock, but it is more effective to boost by putting your shoulder to the wheel.

The third requirement for success of our organization is that its membership should have the spirit of service. It has been well said that life is the pursuit of happiness, which can only be attained through service. Our membership must forget some of its personal desires and think only of our problems to serve the agricultural industry, the basic industry of our nation. Then, let us have faith, action, and a spirit of service.

I recently heard a speaker outline our agricultural development very appropriately under three epochs or areas:

1. The Art of Agriculture, which has been practiced since the beginning.

2. The Science of Agriculture, which is now being put into practice and is a result of the work of our experiment stations.

3. The Business of Agriculture, which is now being emphasized and is a result to a certain extent of the present economic stress the farmer is experiencing.

It is unnecessary for me to dwell on the part the application of engineering has had in developing the art of agriculture. It has virtually changed it from the mere grubbing of a living out of the soil under the hardest conditions to a productive business where the farmer can live under as good or better conditions than people in the cities.

As to the practice of the science of agriculture every thinking man knows that it is made possible by the application of engineering principles.

The analyst can tell us that our soil needs limestone or phosphorous, but it takes a man of mechanical skill to make it possible to apply this material on a practical basis.

The entomologist can determine the anatomy of the insect pest that is destroying our crops or retarding the growth of our animals, but it is a problem in mechanics to apply the poison effectively to destroy the insect.

The animal pathologist can tell us that our animals are less resistant to disease by being housed in dark close buildings, but it is a problem in engineering to provide adequate sunlight and fresh air.

The dairy bacteriologist tells us our milk that shows a high bacterial count is dangerous to the health of the public and the bacterical count must be reduced. The engineer by proper construction and application of the principles of drainage and ventilation provides a sanitary dairy barn, and by pasteurization and the use of refrigeration and other special equipment it is possible to deliver pure milk a thousand miles or more from the point of production.

There is no question but that the practice of scientific agriculture is made possible by the application of engineering principles. Now that we have come to this third era in agricultural development, the business of farming, what part will the engineer take. It is my belief that he will play an even greater part than in the past and will gain wider recognition of the part taken in the solution of the farmer's problems.

If we will analyze the farmer's present problem, which nearly everyone claims is economic, and will aid in its solution there can be no greater service we can render to the American people. We are beginning to realize the truth of the statement that we must have prosperous agriculture to have a prosperous satisfied nation. The farmer is more deserving than any other group because he at least has never laid down on his job.

Let us think more toward the solution of a problem rather than the promotion of an ideal. Let us think of the farmer's needs and forget our selfish desires. Let us analyze the farmer's need, and ability to buy sanitary equipment, and not promote the idea of a bath tub for every farm. Let us analyze the farmer's power need as far as it can be done, and avoid being accused of promoting a particular type of power.

What is the farmer's problem? Don't we all agree that it is mainly one in economics? There must be less wastes

*Remarks by President Lehmann upon taking office at the closing of 16th annual meeting of the Society, St. Louis, December 29, 1922.

on the farm, and the farmer must get more for what he produces. There must be a smaller differential between the prices the farmer gets and that the consumer pays.

If these are the problems of the farmer it is important that better business in farming be emphasized at every opportunity. I believe the farmer who thinks will agree there is need of the solution of the following four basic problems, which are not new to us:

1. Efficient and economic production.
2. The maintenance of a productive soil.
3. A satisfactory marketing system.
4. A satisfied home life.

It is unnecessary for me to discuss the part the engineer plays in efficient and economic production. Yet we have many problems to solve in this connection. Including problems in selection of power, equipment, types of buildings, etc., and then use; also problems in drainage and prevention of soil washing, etc.

A few days ago I read a newspaper quotation of a statement purported to have been made by the director of agricultural extension work in Indiana, to the effect that plowing with horses was the cheapest method for the farmer, and by having good horses on the farm it would be a greater attraction for the youth to remain on the farm. It sounds to me like a rather loose statement, but it does indicate the need of a better understanding of the problem. I believe it is as great a mistake to advocate all horse power as to advocate all mechanical power.

The great problem that we all must recognize for a permanent agriculture and a strong nation is the problem of soil conservation. It has been well said that "it is the decrease of soil fertility and not war that is fundamental in bringing about the decay of a nation." Roosevelt said, "While unquestionably nations have been destroyed from other causes, I have been convinced that it was the destruction of the soil itself which was perhaps the most fatal of all causes."

The mechanics of the problem of soil maintenance must not be overlooked by our soils experts. Drainage and soil erosion problems are fundamental. Equipment and machinery for making it possible to apply limestone, rock phosphate, and other elements of fertility on a practical basis must be provided by engineers. This involves machinery, storage, transportation, and implements for distributing the material on the land. This Society should lend a hand toward the solution of this problem. We might well have a committee to investigate the question of machinery and equipment as factors in a program of permanent agriculture.

Omitting the question of credit and the individual farmer's needs, the big problem of marketing is a problem in engineering. It involves problems in storage, transportation, (the motor truck and good roads are factors), refrigeration, the manufacture of agricultural products, and the getting information on the market situation to the farmer. The radio is now playing a part in this connection and deserves further study.

I feel the need of a special committee to study the subject of storage in relation to the farmer's marketing problem. This is not a new question. Joseph of old was the original expert on storage to secure an orderly market. He stored in times of plenty and distributed the product as the demand became greater.

I believe we should also have a committee on the manufacture of agricultural products as a factor in marketing. We are all familiar with what has been done toward stabilizing the dairying industry by the application of engineering principles. We even have men who might be called dairy engineers. With the multiplicity of machines it is a profession in itself.

Other interests might well be studied. The horticultural field is a good example. A new horticultural field laboratory representing an investment of nearly $200,000 at the University of Illinois is primarily a venture in mechanics. With its refrigeration equipment. its equipment for canning, equipment for evaporating fruits and vegetables, its equipment for making cider and vinegar, the products of the orchard and garden can be converted into products ready for the consumer without waste.

There are present problems in the utilization of the soy bean that should have our attention. Farmer organizations are already building and equipping plants to convert soy beans into meal which can be used as feed locally and oil which can be sold to commercial trade with a minimum loss. A committee to study the whole question of soy bean machinery could make a valuable contribution at this time.

In working toward the solution of the marketing problem we might well devote some thought also on the questions of refrigeration and transportation. These questions are now being investigated by the U. S. Department of Agriculture, and also by some of the commercial organizations. The membership of this Society might well devote some time to these questions. While emphasis has been put on production by nearly all other agencies interested in agriculture, this Society has not overlooked the fact that the well-being of the farm family is essential. Farmers as a whole need better homes, better equipped for health, happiness, and efficiency. Efficiency engineers have long since recognized this need in industry. All of our members in educational work can well afford to emphasize this need. Of course, we must have production first before we can have these things. Production is a means to an end.

There are no doubt special problems that will develop that should have our attention during 1923. I hope the membership will call such problems to my attention. The need of investigating certain questions has already been suggested as follows:

E. W. Lehmann

President of the American Society of Agricultural Engineers for 1923, is professor of farm mechanics, University of Illinois. He was born and raised on a farm in Mississippi, and was graduated in 1910 from the Mississippi A. & M. College with the degree of bachelor of science in electrical engineering. He was awarded the professional degree of electrical engineer from Texas A. & M. College in 1913. In 1914 he was granted the bachelor of science degree and in 1919 the professional degree of agricultural engineer from Iowa State College.

From 1914 to 1916 Prof. Lehmann held positions of instructor and assistant professor of the agricultural-engineering staff at Iowa State College. In September 1916 he was appointed associate professor and chairman of the department of agricultural engineering at the University of Missouri. He was advanced to full professor in September, 1919. In June, 1920, he became agricultural-engineering editor of "Successful Farming," and in September, 1921, he was appointed to his present position as professor of farm mechanics and head of the department at the University of Illinois.

Prof. Lehmann, in addition to a wide experience in teaching and organizing agricultural-engineering courses, has done considerable research work, and is also author of a large number of valuable bulletins, books, and articles on various phases of agricultural engineering.

1. Rural power lines.
2. Belting investigation.
3. Positions for agricultural engineering graduates.
4. Aims and objectives of an agricultural engineering curriculum.
5. Standardization of farm building blue print service.

It will be well to state all our problems for committee work very definite and specific rather than too general. A definite problem lends itself to a more direct attack. For example, our committee on Soil Erosion might well devote a year to the economics of the mangum terrace. Our committee on Farm Building Design might devote a year to the farm home, the committee on Power Farming devote a year to the Economics of the tractor as a power unit, and so on throughout the list.

Our aim for 1923 should be for every member to contribute toward the work of the Society. We must not forget that in cooperation we make our greatest gains. I would again emphasize that every member of our Society should pick out one or two committees to which he will contribute whether he be a member of the committee or not, every member should feel this responsibility. Let us all have the attitude, "If I haven't contributed toward a Committee, I will not criticise it for lack of results."

Let us have faith, an active membership, a spirit of service, and cooperation.

Standardization of Farm Motors Courses*

By **W. J. Gilmore**

Professor of Farm Mechanics, Oregon Agricultural College

QUESTIONNAIRES were sent to fifty institutions in the United States and Canada, asking for information relative to farm power courses. Only seventeen institutions replied and from these the following report is made.

A majority of the students taking the course were collegiate students in agriculture. The number of vocational agricultural students taking farm motors courses was not small. Vocational instruction in this work was given to students taking short courses from two weeks to those taking a two years' trade course. Collegiate agricultural students elected this course or were required to take it, depending upon the course they were following and the institution they were attending. Freshmen, unless they were taking an agricultural engineering course, usually were not taking this work. If the course was prescribed it was usually taken in the sophomore year, or in the junior or senior years, if majoring in one of the agricultural groups, such as animal husbandry, dairy, horticulture, etc. In some of the above groups farm motors was required, in others the student could select it as an elective.

Students taking commerce, industrial arts, engineering, and those preparing themselves for teachers of agriculture (Smith-Hughes) were among those electing farm motors courses. In those institutions having a strong commerce department and no opportunity to major in agricultural engineering, it is noted that many of the commerce students elect agricultural engineering courses to assist them in securing positions with commercial firms. Industrial arts students as well as those majoring in industrial education evidently are awake to the fact that farm shop in many schools is becoming more popular than is industrial arts, and desire to fit themselves for both lines of work. They, therefore, are among students electing farm motors in several institutions.

From two to five credit courses were given. In some institutions five credits are given to degree students, and three to vocational students. In other schools four and five credit courses are given, combining motors work with implement or repair work. The equivalent of a three credit course in motors seems the most popular, whether given as a unit farm motor course or combined with other agricultural engineering subjects.

Classes met from one to three times a week in lecture and from one to four times a week in laboratory, depending somewhat on number of credits given. The length of laboratory period was from two to four hours in length, with an average of 2 2-3 hours. There was no indication that any time was given to demonstrations or recitations. It was noted that some institutions did not permit meeting classes more times per week than number of credits given. In a few cases where the work was elective, the proportion of lectures and laboratory work was determined to some extent by time open to those permitted to elect the work. It is evident that where repair work such as babbitting and fitting a bearing or where repair work necessitated dismantling a motor that three or four hours is not too long a period, but where the work was in the nature of a report that from two to three hours is sufficiently long. The nature of work in the farm motors course was noted as a factor in determining the proportion of lecture to laboratory. In some cases farm motors work was given along with overhauling motors. In this case the student was often held for a four hour laboratory.

Ten reported terms of twelve weeks while seven reported terms of eighteen weeks.

There is a great variation in the number of examinations per term. The minimum was one for the eighteen weeks term, and the maximum was four for the twelve weeks term. Averaging, it is found that one examination is given every six and one-half weeks, which would be equivalent to approximately two examinations for the twelve weeks term and three for the eighteen weeks term. In no case were oral examinations mentioned nor were any institutions listed as unfavorable to written examinations. In one case no final examinations were given by the school.

The average size of sections in farm motors courses was twenty-four students. One institution mentioned that fifty were permitted, another mentioned thirty, while another mentioned thirty-five. In another twenty were desired but that thirty-five were permitted. Eliminating the institutions above, it is found the average size section to be twenty students. Six instructors stated that they preferred twenty students in a section, while four preferred twelve to fifteen students.

Eleven reported that manuals were used while five stated that they were not. Two of the eleven using manuals stated that Scoates' manual was used. One stated that a manual was not used because more could be accomplished without one.

*Sixteenth annual meeting paper.

Instructors were divided on care of notebooks. Some kept them in open racks in laboratory, some under key in laboratory, while others permitted students to take their notes to their rooms.

It is extremely difficult from the questionnaire to learn how the various courses in farm motors are subdivided. Many give as high as fifty per cent practical work, others give no practical work at all. The average instructor giving no practical repair work is devoting time as follows to various phases of work:

	per cent
Engine construction and engine principle	20
Valve timing—magneto timing	5
Ignition	15
Fuels	5
Carburetors	10
Lubricating systems	10
Oils	5
Governors	5
Brake tests and operation	20
Cooling systems	5

In some cases the above work is given on one cylinder stationary engines only, leaving work on all four-cylinder motors for the tractor and truck course following. Some institutions include farm electric plants with the motors course. Usually little attention was given to starting and lighting systems in the regular farm motors course; this usually was placed in the automobile courses.

Steam and the horse as a farm motor was given little attention in farm motors courses; electricity was covered only as pertaining to gas engine ignition, starting and lighting systems and farm lighting. One institution mentioned giving some time to the air motor. Windmill work, if mentioned, was placed in the farm implement course.

A large number of different texts are being used to give the motors work. Several schools mention using a combination of two, or three texts, mentioning others as reference. It is quite evident that some difficulty is experienced by many instructors in selecting a satisfactory book for the work they give. Books used as texts are as follows:

"Motor Vehicles," by Fraser and Jones.

"Farm Motors," by Potter.

"Gasoline Automobile," by Hobbs, Elliott and Consoliver.

"Gas Engine Ignition," by Norris, Winning and Weaver.

"Gas Engine Ignition," by Hirschfield and Ulbright.

"Gas Engine Ignition," by Whitman.

"Gas Engine Ignition," by Heldt.

"Farm Motors and Farm Implements," by Davidson and Chase.

"Equipment for Farm and Farmstead," by Ramsower.

"Automobile Encyclopedia," by Dyke.

Twenty-five per cent of the equipment used to give the motors courses at the seventeen colleges was owned by the institution, while seventy-five per cent was borrowed from manufacturers. The larger schools borrow more than the smaller ones. As high as ninety-five per cent is borrowed in two cases, and in one case none is loaned by manufacturers. There was no indication that difficulty was experienced in securing loans for educational purposes.

It is found that little use is made of films in giving farm motors courses, but that some institutions report ownership of five hundred and another three hundred slides covering motors. The majority state that slides and films were used very little but that they intend using them more in the future.

The writer realizes that this report is nothing more than a survey of farm motors work as carried on at several institutions. There is, we believe, an opportunity to standardize much work in agricultural engineering at the various state institutions. Agricultural engineering work lends itself to standardization more than the work in horticulture, dairying, animal husbandry, and crop production, since local conditions determine, to a greater extent, the nature of the crops and livestock work than it does the agricultural engineering work. It is, of course, difficult to standardize the entire work in agricultural engineering since such factors as the number of terms per year, the amount of work per credit, and required work varies so much at different institutions. However, there is opportunity for much constructive work along standardization lines which will assist instructors in making their work more effective.

There is need of a text which more nearly suits the conditions than does any one text now published. This could be written jointly by several instructors in agricultural engineering, and adopted by a sufficiently large number of institutions so that it could be revised frequently. By dividing the work so that one instructor would take but a few chapters and the several chapters be correlated by a committee, we would have a better text than is now used.

A laboratory manual could also be prepared jointly, keeping in mind the equipment common to the average department, the text above referred to and the conditions prevailing at the average institutions.

Suggestions for equipment to use to give the courses would be of assistance to many, especially those starting courses. Correlation of the work in the various subdivisions of agricultural engineering offers an opportunity for further work by a committee. There is a great variation in the combinations of courses taught. As mentioned previously, some institutions include practical work, such as babbitting with farm motors; others place this in the tractors course, while others combine motors and tractors and follow with a repair course. Some include farm electric plants with motors; others do not. We realize that local conditions determine to a large extent the combinations, but realize also that at some institutions the instructor would be assisted greatly if a committee of agricultural engineers would suggest combinations approaching the ideal, if this is possible.

Discussion by C. W. Smith

Mem. A. S. A. E. Division of Agricultural Engineering
University of Nebraska

BY WAY of introduction I shall state as tersely as possible what I consider the most pressing problem suggested by the topic. The presentation of farm machinery instruction, as well as that in farm motors, is missing fire—going broad of the mark. A considerable portion of these courses, as generally given, is not of college caliber. Neither subject should be taught as a unit in itself and apart from the other in an agricultural college. My remarks will aim to substantiate these statements.

First, is the present instruction missing fire? To answer this question it becomes necessary to decide on what the aim and purpose of each of these courses should be. In glancing through some correspondence that Prof. O. W. Sjogren had regarding the teaching of farm machinery I found some statements of what the purpose of such instruction should be, and I am taking the liberty of giving a few of them here as examples of what I think to be very near the right viewpoint.

Prof. R. A. Andree in speaking of the farm machinery course says, "We give as much practicable experience as possible, and I am sure that this goes a long way in keeping up the student's interest."

Prof. J. B. Davidson said they found themselves switching over more to the demonstration plan, conducting quite a little field work under actual conditions.

Prof. F. W. Duffee says, "I believe the primary object of a course in farm machinery should be to teach the students efficient operation, and this is the keynote of the laboratory work. The object of second importance is the selection and adaptation of proper sizes."

What will the student be called upon to do with farm machinery or know about it after finishing college? It

depends upon what vocation he follows but in a rather rough manner we can divide our students into three classes. The first class is made up largely of men directly interested in farming and who will go back to the farm after finishing their course. The second class includes men who will be found teaching after finishing their college course, although they had not planned to teach until perhaps their senior year. A third class is relatively small and is made up of students studying to be trained agricultural engineers.

The first class is the largest, and the men in it are the general agricultural students, not majoring in agricultural engineering but taking such courses as a means to the more successful operation of a farm. The course must certainly be organized to fit the needs of the greatest number, and those falling in one of the minority groups will have to be taken care of by individual attention, special courses, or merely proceed with the others at a certain known disadvantage. Then what will these general agricultural graduates be called upon to do pertaining to farm machinery? Most likely one of two things: they will be operating it themselves, or superintending large farms with considerable hired help and in the latter case it may often be possible for the manager to avoid expensive delays by knowing machinery. In either case, skill in getting service out of the machine at hand is the essential and all important thing.

This calls for a very definite knowledge of machinery, of the adjustments to be made to accomplish the task at hand. There is only one way to attain such skill and that is by actual manipulation. This I claim can be done in such a manner that it will call for more thought processes than the old method, for what will answering a set of questions bringing out the details of construction of several machines prepare a man to do? My experience in salesmanship is rather limited, but it appears to me that such a procedure would be correct and valuable for one aiming to go on the road as a salesman for some machinery firm. Needless to say that is not the main purpose of an agricultural college course. Such a procedure may help men to be more discriminating in buying machinery, but again the simple proposition of buying where service can be obtained so completely overshadows the former that it sinks into insignificance and could not warrant a semester or more of time. Without carrying the subject further in this direction it seems obvious that a large proportion of a student's time should not be spent in writing answers, the sole purpose of which will be to satisfy the teacher that certain observations had been made as asked.

My second assertion at the outset was that much of the present instruction in these courses is not of college calibre. Compare if you will this typical portion of a college exercise in farm machinery—

> Wheels—open, solid, or double? Circumference at rim?
>
> Give a list of the assortment plates found with the planter,—with a portion of a laboratory requirement in college physics as follows:
>
> Experiment: To find the center of gravity of a body; to verify the principle of moments; and to study the theory of weighing. (This followed by ample directions for attaining the object.)

Further comment is unnecessary. We should be spurred with an intense zeal to get real food for grown-ups into our courses and eliminate all else.

The third preliminary assertion was that neither farm machinery nor farm motors should be taught as a unit in itself and apart from the other in an agricultural college. They are not used that way on the farm. You have sensed my emphasis on practical manipulation. This can not be done successfully with either alone. Either a previous knowledge of one or the other must be assumed or both must be used and studied together. I believe that any standardization of these courses will be fundamentally wrong if one of these subjects is isolated from the other.

A SEMESTER PROGRAM FOR A GENERAL AGRICULTURAL ENGINEERING COURSE

Lectures	Laboratory
1. Engine principles	1. Operation of gas engines
2. Valve timing	2. Timing valves on stationary
3. Valve timing	3. Timing valves on stationary
4. Ignition principles	4. Timing valves on multiple cylinder
5. Vibrating coil systems	5. Ignition lab. on principles
6. Non-vibrating battery systems	6. Ford system
7. Low-tension magnetos	7. Non-vibrating battery systems
8. High-tension magnetos	8. Low-tension magnetos
9. Timing ignition	9. High-tension magnetos
10. Batteries	10. Timing ignition
11. Starting and lighting	11. Timing ignition
12. Fuels and carburetion	12. Timing ignition
13. Carburetors	13. Carburetors
14. Lubrication and bearings	14. Carburetors
15. Bearing adjustment	15. Pouring bearings
16. Clutches	16. Pouring bearings
17. Brakes and tires	17. Adjusting connecting rods
18. Transmission of power	18. Adjusting clutches
19. Principles of the plow	19. Adjusting brakes
20. Principles of the reaper	20. Brake tests
21. Principles of the thresher	21. Lubrication systems
22. Tractor operation	22. Tractor operation
23. Tractor operation	23. Tractor operation
24. Farm light plants	24. Farm light plant operation
25. Farm water systems	25. Farm water system operation
26. Hitches	26.

ADVANCED AGRICULTURAL IMPLEMENTS

Lecture	Laboratory
1. Mechanical efficiency	1. An efficiency stationary engine B. H. P. test at varying loads
2. Thermal efficiency	2. Same as above
3. Report on B. H. P. test	3. An efficiency test on farm lighting plants
4. Battery characteristics	4. An efficiency test on farm lighting plants
5. D. C. Generator characteristics	5. An efficiency test on farm lighting plants
6. Report on farm light plants	6. A farm water supply test
7. Farm water supply solution	7. A farm water supply test
8. Report on farm water systems	8. Tractor (belt) B. H. P. test
9. Engine dimensions and ratings	9. Tractor (belt) B. H. P. test
10. Report on tractor test	10. Threshing machine manipulation
11. Tending the separator	11. Threshing machine manipulation
12. Tending the separator	12. Threshing machine manipulation
13. Binder service	13. Binder manipulation
14. Binder service	14. Binder manipulation
15. Binder service	15. Binder manipulation
16. Trouble shooting (gas)	16. Stationary engine trouble sheet
17. Trouble shooting (gas)	17. Stationary engine trouble sheet
18. Bearing adjustment	18. Tractor trouble shooting
19. Ring fitting—valve G	19. Tractor trouble shooting
20. Carbon removing—wheel adjustment	20. Overhauling
21. Clutch repairing	21. Overhauling
22. Graphiting springs	22. Overhauling
23. General repair and upkeep	23. Overhauling
24. Laying out fields	24. Field work—plow manipulation
25. Plow adjustments	25. Field work—plow manipulation
26. General machinery equipment	26. Field work—plow manipulation
27. General machinery equipment	27. Farm equipment for various sized farms
28. General machinery equipment	28. Farm equipment for various sized farms
29. Reports on farm equipment	29. Farm equipment for various sized farms
30. Reports on farm equipment	30. Farm equipment for various sized farms

Most of what has been said regarding farm machinery applies equally to the instruction commonly given as farm motors. An uninterested party scanning our motor courses might easily judge the students to be preparing for general garage work, or for the position, long since defunct, of traveling expert for some large company. Much of this is missing the mark.

Fearing that what I might say would be too general, not be specific and constructive, I have hastily outlined two semester courses based on the plan suggested and will point out the trend of work beyond the second. These outlines must be understood to be only suggestive and for the purpose of bringing out the discussion. They have not been used as here presented. Our experience with other preliminary drafts leads us to believe that this one would be modified considerably after it had been used one semester. But the aim has been to give in Course I largely the principles under-

lying both farm machinery and farm motors and only so much along any one line as will furnish a basis for independence and logical thinking whether in the following course or in bumping up against problems in every day life. The thought has been kept in mind that if a man were able to take only one course it had been arranged to do him the greatest possible good and at the same time open up numerous avenues that would invite further study in the advanced course.

Very few details of construction will be studied in Course I; only those that get some secondary consideration and which had to be observed in bringing out some general principle. In casting about for names for such courses I decided to call them Agricultural Implements and Advanced Agricultural Implements. The whole field of machinery as well as motors is survey in Course I, with the double purpose, first, of giving every student, if only for a semester, an opportunity to see the possibilities of all phases of agricultural implements, and, second, to give enough familiarity to all students who may continue with an advanced course to make it possible to make assignments on any phase of the work and be able to expect initiative together with a considerably lessened degree of supervision.

The lecture periods of the second course have been arranged to be most helpful to the laboratory end, a considerable number being taken by reports on laboratory work. The laboratory work will present a problem to the student who has had just enough preliminary experience together with immediate suggestions to cope with it. He is graded by the teacher in action on the problem as well as on the oral presentation of any results obtained. Time forbids going into more detail. We submit in conclusion two outlines with twenty-five or twenty-six definite lecture and laboratory periods leaving the difference between this and thirty-six for quizzes and for adaptation to local conditions.

While we were teaching in the high schools we were accustomed to the annual visit of the high school inspector, who after looking over the equipment for teaching the sciences and observing some of the instructional work pronounced judgment as to whether the school should be on the accredited list. Why should not the American Society of Agricultural Engineers appoint an inspection committee whose duty it was to visit each college trying for an accredited standing by following the plan worked out by a standardization committee? Cannot such a move be gotten on foot this session?

Degree Course in Agricultural Engineering

By **E. A. Stewart**

Mem. A.S.A.E. Division of Agricultural Engineering

THE colleges of the Middle West are recognizing more and more the need and value of men trained as engineers along agricultural lines. The tremendous increase in power machinery and other farm equipment, the increased demand for modern home improvements, the increased complexity of building materials and equipment, the tremendous value of properly reclaimed lands, together with the absolute necessity of economical purchasing and operation of this machinery and equipment has created a need for expert help and advice along agricultural engineering lines. This need for help has created many openings where men with a technical training along agricultural engineering lines have found a place for service to mankind. When we see the costly mistakes that farmers are making in building homes and barns, in purchasing equipment and machinery, and in improper methods of reclamation, it is very clear that much more expert help is needed. However, before extensive help can be given, men must be trained along agricultural engineering lines, and a great amount of research work needs to be done. Some of the supposed help along these lines in the past has been about as detrimental as it has helpful, because considerable of the help was based on opinions and ideas, instead of on facts, proven or discovered by research. In order to secure trained men and to develop a research corps and research facilities in agricultural engineering, it is necessary to have professional courses in agricultural engineering established in our strongest colleges and universities.

There are five colleges that are giving professional work in agricultural engineering leading to the degree of bachelor of science in agricultural engineering. These colleges named in the order of the organization of the course and the date of organization are as follows: Iowa State College, 1909; University of Nebraska, 1909; Kansas State Agricultural College, 1914; University of Missouri, 1917; Agricultural and Mechanical College of Texas, 1921.

Only four of these institutions had graduated any students in this line until 1921. At that time, one hundred fifty-seven had received the degree of bachelor of science in agricultural engineering, fourteen had received post graduate degrees, and there were one hundred seventy-three students receiving training in professional courses.

Several other state colleges are giving a number of technical courses to students in the colleges of agriculture, who may major or minor in agricultural engineering. Nearly every large college or university is included in this group. The men who receive this training are not qualified as experts along engineering lines, but they are filling a very useful field in educating the people to the value of engineering training in agriculture, and they are also building up many positions which will soon be occupied by professional engineers. Their training is too meager in engineering to enable them to render good service in professional work, as soon as the public is acquainted with the help and service that agricultural engineers should give.

In addition to the students in these two classes, there are thousands of students taking one or more courses in agricultural engineering as elective studies. There were about 7,600 such students enrolled in courses in agricultural engineering in ten of the largest colleges last year. It is quite probable that the total number of such students enrolled in the twenty-six colleges which offer work in agricultural engineering will exceed 13,000. The number of students in this group is increasing rapidly. Many graduates of agricultural colleges who went through school without some of this work, are now coming back to get it, and usually to get more than one or two courses. They see the need of more training along this line for teachers of agriculture in high schools, for county agents, etc. In order to provide a faculty of trained specialists to teach this group, and to provide men to fill the professional places that this group of men will create when they get out into field work, we need professional courses in agricultural engineering in our best colleges and universities.

There are at the present time about one hundred forty men engaged in teaching agricultural engineering in the colleges and universities and about thirty more doing extension work. What is the training of these men? Less

than one-half have received training in agricultural engineering. The others have received training in other types of engineering, in engineering science, or in agriculture, and because of their sympathy, their position, or their boyhood training have taken up agricultural engineering. A larger percentage of the faculties in the future must be trained in their special line. The success and reliability of agricultural engineering demand a body of more highly trained engineers. While there will always be a number of men trained in other lines that will make first-class professional agricultural engineers, the same as we find that some of the faculty in electrical and civil engineering have been trained in other lines, yet the large percentage of successful agricultural engineers in the future will be those that have been trained in professional courses along that line.

The division of agricultural engineering at the University of Minnesota started a movement two years ago to inaugurate a professional course in agricultural engineering. Some of the details of the course were discussed during the past year, and at one time it appeared as though the course might be inaugurated last year. There are a number of details yet to be settled. It is highly probable that such a course will be inaugurated during the present college year.

A number of the members of the division of agricultural engineering have worked out a proposed course. It is proposed to have the course administered jointly by the Deans of the college of engineering and the college of agriculture. The curriculum for such a proposed course has been given a great deal of study. We believe that a good foundation of pure science, mathematics, and some cultural subjects are more important to an engineer than some highly specialized subjects in either general engineering or his special engineering line. The proposed curriculum developed along such lines will be found at the end of this article. The names of the courses do not in many cases indicate the scope or caliber of the work.

After the proposed curriculum was developed we wished to see how close we had arrived at a happy medium with a strong inclination to fundamentals. We then worked out the accompanying percentage table. This is based on the credits allowed. It is quite difficult to make a satisfactory analysis of different curricula, since the courses in one college are not comparable with those in another. It is quite difficult to separate some courses as agricultural or pure science, as science or engineering. In addition to these difficulties, there is the selection of alternate electives within the division that will vary the percentages in the different curricula selected by students.

In order to guide any one if they wish to study this further, I have indicated how the courses in our proposed curriculum were divided. The number following the name of the course indicates the group to which I assigned the subject as shown in the following classification:

1. General engineering.
2. Agricultural engineering.
3. Science.
4. General agriculture.
5. Cultural subjects.

It appears from the table that the colleges are fairly well agreed on the amount of engineering that should be required. The only point of difference is in the distribution between general engineering and agricultural engineering. The

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PROPOSED COURSE IN AGRICULTURAL ENGINEERING,
University of Minnesota
(Leading to the Degree of Bachelor of Science in Agricultural Engineering.)

FRESHMAN YEAR

Fall Quarter

			Credits	Rec.	Lec.	Lab.
M. & M.		Applied Mathematics and Mechanics, 1	5	..	5	.....
Chem	4	*General Inorganic Chemistry, 3,	4	.....	3	..3
or Chem	14	General Inorganic Chemistry, 3	5	.....	3	..6
Draw.		Engineering Drawing, 1	3	.....		..9
Mech. Eng.	11	Shop Practice, 1	2	.....		..6
Gen. Eng.	11	Orientation, 1	1	.....	2	...
		Military Drill	0	.....		.....

Winter Quarter

M. & M.	12	Applied Mathematics and Mechanics, 1	5	..	4	...2
Chem.	5	*General Inorganic Chemistry, 3,	4	.....	3	..3
or Chem	15	General Inorganic Chemistry, 3	5	.....	3	..6
Draw.	2	Engineering Drawing, 1	3	.....		..9
Mech. Eng.	12	Shop Practice, 1	2	.....		..6
Gen. Eng.	11	Orientation, 1	1	.....	2	...
		Hygiene and First Aid, 5	0	.....	1	...
		Military Drill	0	.....		.....

Spring Quarter

M. & M.	13	Applied Mathematics and Mechanics, 1	5	..	4	...2
Farm. Eng.	40	Mechanical Training Laboratory, 2	2	.....		..6
Draw.	3	Engineering Drawing, 1	3	.....		..9
Mech. Eng.	13	Shop Practice, 1	2	.....		..6
Farm Eng.	8	Farm Engineering, 2	5	.....	5	...
		Military Drill	0	.....		.....

*Students who have had chemistry in high school will take Chemistry 4 and 5, others Chemistry 14 and 15.

JUNIOR YEAR

Fall Quarter

Agronomy	1	Farm Crops, 4	3	.....		..6
Farm Eng.	18	Surveying, 2	5	..	2	...9
Econ.	5	General Economics, 5	5	.....	5	...
		One or both of the following two:				
Farm Eng.	135	Ignition Systems, 2	3	..	1	..4
Farm Eng.	5	Framing & Building Construction, 2	3	..	1	..4
		One or more electives	2	.....		.....

Winter Quarter

Econ.	6	Agricultural Economics, 4	3	.....	3	...
Farm Eng.	20	Steam Boilers and Engines, 2	3	.....	2	..3
M. & M.	92	Mechanics, 1	4	.....	4	.....
Farm Eng.	7	Farm Structures, 1-2	3	.....	2	..3
		One or both of the following two:				
Farm Eng.	134	Agricultural Hydraulics, 2	4	.....	3	..3
Farm Eng.	36	Rural Heating and Ventilation, 2	4	.....	3	..3

Spring Quarter

Agronomy	11	Farm Machinery, 2	3	.....		..6
M. & M.	93	Strength of Materials, 1	4	.....	4	.....
		One or both of the following two:				
Principles of Drainage, 2			5	..	2	9
Farm Motors III, 2			5	.....	2	..4
One or more electives			6 or 8			.....

Suggested Electives

Bact.	1	General Bacteriology	5	.....	3	..6
Hort.	71	Landscape Gardening	3	.....	3	...

Farm Eng.	31					
Farm Eng.	120					

SOPHOMORE YEAR

Fall Quarter

M. & M.	24	Applied Mathematics and Mechanics, 1	5	..	5	.....
Farm Eng.	24	Agricultural Physics I, 3	4	.....	3	..3
Rhet.	1	Rhetoric I, 5	3	.....	3	.....
Soils	4	Soils, 4	3	.....	2	..2
Farm Eng.	13	Farm Motors, 1-2	3	.....	2	..4
		Military Drill	0	.....		.....

Winter Quarter

M. & M.	25	Applied Mathematics and Mechanics, 1	5	..	5	.....
Farm Eng.	25	Agricultural Physics II, 3	4	.....	3	..3
Rhet.	2	Rhetoric II, 5	3	.....	3	.....
Ag. Biochem.	7	Agricultural Biochemistry, 3	5	.....	3	..6
		Military Drill	0	.....		.....

Spring Quarter

Farm Eng.	54	Applied Electricity, 2	5	..	3	6
Rhet.	3	Rhetoric III, 5	3	..	3	.....
Ag. Biochem.	8	Agricultural Biochemistry, 3	5	.....	3	..6
Soils	5	Soil Fertility, 4	3	.....	2	..2
		Military Drill	0	.....		.....

SENIOR YEAR

Fall Quarter

Agronomy	102	Farm Management II. (Organization, 4)	3	.....	3	...
Farm Eng.	37	Rural Sanitation, 2	3	.....	3	...
		Two or more of the following four:				
Farm Eng.	42	Principles of Irrigation, 2	3	.....	3	...
Farm Eng.	43	Earth Roads, 2	2	.....	2	...
Farm Eng.	111	Structural Materials I, 2	3	.....	2	..3
Farm Eng.	121	Farm Power Machinery, 2	4	..	1	..2..6
		One or more electives	4 or 5			.....

Suggested Electives

Dairy Husb.	1	Elements of Dairying	5	.....	3	..4
Animal Husb.	1	Types and Breeds	5	.....		..10

Winter Quarter

Agronomy	103	Farm Management II. (Operation, 4)	3	.....	3	...
Gen. Eng.	101	Contracts and Specifications, 1	3	.....	3	...
		Two or more of the following four:				
Farm Eng.	112	Structural Materials II, 2	3	.....	3	...
Farm Eng.	102	Irrigation Engineering, 2	3	.....	2	..3
Farm Eng.	103	Drainage Engineering, 2	4	.....	2	..6
Farm Eng.	28	Land Clearing, 2	5	.....	3	..4
		One or more electives	4 or 6			.....

Suggested Electives

Forestry	27	Groves and Windbreaks	3	.....	3	...

Spring Quarter

Pol. Science	27	Business Law, 5	3	.....	3	...
Farm Eng.	150	Seminar, 2	1	..	1	.....
		Two or more of the following five:				
Farm Eng.	101	Advance Drainage, 2	3	.....	1	..6
Farm Eng.	113	Farm Structures II, 2	3	.....	1	..5
Farm Eng.	122	Power Farming, 2	4	.....	3	..3
Farm Eng.	104	Drainage Administration, 2	3	.....	3	...
Farm Eng.	136	Experimental Physical Analysis, 2	5	.....	2	..9
		One or more electives	5 or 7			.....

TABLE SHOWING COMPARISON OF AGRICULTURAL ENGINEERING CURRICULA AT FOUR STATE AGRICULTURAL COLLEGES

IOWA STATE COLLEGE	per cent
General Engineering	29.3
Agricultural Engineering	26.4
Science	13.6
General Agriculture	19.0
Cultural Subjects	6.3
Military	2.7
Elective	2.7

KANSAS STATE AGRICULTURAL COLLEGE	per cent
General Engineering	41.8
Agricultural Engineering	13.1
Science	17.0
General Agriculture	13.1
Cultural Subjects	13.1
Military	2.8
Elective	0.0

UNIVERSITY OF NEBRASKA	per cent
General Engineering	40.0
Agricultural Engineering	22.3
Science	12.8
General Agriculture	5.6
Cultural Subjects	8.8
Military	3.3
Elective	7.2

UNIVERSITY OF MINNESOTA (Proposed)	per cent
General Engineering	25.2
Agricultural Engineering	28.6
Science	15.3
General Agriculture	8.6
Cultural Subjects	8.1
Military	2.8
Elective	11.4

fact that the course in agricultural engineering is under the single control of the college of engineering at Nebraska and Kansas is reflected in the preponderance of general engineering. The slight shift in percentages in favor of agricultural engineering in the course at Minnesota is due to two causes: (1) The division of agricultural engineering at Minnesota is already well organized and has quite an extensive group of courses that it is offering. Some courses, like surveying, are now given from an agricultural viewpoint, and our students should take these courses rather than the courses offered in general engineering. (2) The division of agricultural engineering is on the agricultural campus and separated from the main campus. It has a well-equipped building and is well housed. We believe that if a special course in any engineering line is necessary for the students in agricultural engineering, such a course should be given by the men who are carrying on research work along the applied line and who are in close touch with the related lines that are strictly agricultural engineering. We consider that such courses as mechanical training (often called farm shop mechanics), surveying, principles of drainage, agricultural hydraulics, applied electricity, etc., are courses of this type. The laboratory equipment and the subject material to be used in these courses belongs largely to agricultural engineering. In fact, this is the main difference in the courses as offered.

The difference in subjects is not as great at Kansas and Nebraska as compared to Iowa and Minnesota as the table indicates. Where the two former schools offer subjects that are taken in general engineering without differentiating for the students in agricultural engineering, Iowa gives courses along the same subject lines, especially for agricultural engineers, while the proposed course at Minnesota follows a similar line.

The large amount of work in general agriculture, science, and cultural subjects at Kansas is accounted for by the fact that they do not have any electives. The large amount of general agriculture required at Iowa is taken largely from the electives. We expect that our students would choose a large part of their elective courses in agriculture, science, and cultural subjects. In fact, our list of suggested electives emphasize this choice in the curricula.

The Sixteenth Annual Meeting

"BY THEIR works ye shall know them." This passage of Scripture, true in all times and ages, is full of significance in its special application to the sixteenth annual meeting of the American Society of Agricultural Engineers held in the Jefferson Hotel, St. Louis, Missouri, December 27, 28, and 29, 1922. The most outstanding feature of the meeting was the decided trend toward a more scientific basis evidenced in the papers and reports presented by the members of the Society. While each annual meeting of the Society in the past, particularly in recent years, has marked important milestones in the advancement of the "art and science of engineering as applied to agriculture," the meeting this year marks more than the usual degree of advancement in this direction.

The papers presented at the meeting this year, for the most part, represented the work of members of the Society, who deserve an overflowing measure of credit for their "works." This year many of the papers represented real scientific research.

While the meeting this year did not draw as large an attendance as in former years, it did not lack for interest and inspiration. All sections of the country, from as far west as California and as far east as Connecticut, and from as far south as Texas and as far north as Minnesota, were represented at the meeting this year. Probably at no meeting of the Society has there been more enthusiasm in evidence, as well as a grim determination on the part of individual members to work individually as well as through the Society to promote a more rapid advancement of the agricultural-engineering profession.

The meeting was opened by W. H. Stentz, sales manager of the John Deere Plow Company, St. Louis, as chairman of the local arrangements committee. To Mr. Stentz, and E. B. Borman, local manager of the J. I. Case Plow Works Company, and W. R. Ellis, local manager of the J. I. Case Threshing Machine Company, who constituted the committee on local arrangements, special credit is due for the excellent arrangements they made for the meeting. These men represented the Implement, Vehicle, and Hardware Association of St. Louis, which acted as hosts to the meeting.

The response to the opening remarks by Mr. Stentz was made by the Hon. Henry W. Keil, mayor of St. Louis, who spoke briefly but understandingly of agricultural problems and the function of the agricultural engineer in the process of solving them.

Treasurer's Report for 1922

FOLLOWING is the report of the Treasurer, Frank P. Hanson, of the American Society of Agricultural Engineers for the fiscal year ending December 31, 1922. It will be of interest to members of the Society to know that this statement shows a balance of $220.81 as against a deficit in excess of $2000.00 a year ago.

FINANCIAL STATEMENT OF THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS FOR THE YEAR ENDING DECEMBER 31, 1922.

ASSETS		LIABILITIES	
Union Banking Co.	$469.96	Notes Payable	$532.91
Accounts Receivable	274.00		
Office Fund	2.86	Balance (Gain for the year)	220.81
Accounts Payable*	6.90		
Total	$753.72	Total	$753.72

EXPENSES		RECEIPTS	
Cash Discounts	$ 37.22	Membership Dues	$4,294.67
Printing and Supplies	1,313.05	Member subscriptions to the Journal	1,090.75
Journal Printing	2,915.83	Admission Fees	342.00
Salaries	2,055.00	Journal subscription sales	210.75
Postage	270.13	Journal Advertising sales	2,486.50
Traveling	51.00	General Sales	188.59
Meetings Expense	280.00	Miscellaneous Receipts	449.46
Mis. Expense	1,919.68		
Balance (Gain for the year)	220.81		
Total	$9,062.72	Total	$9,062.72

*"Accounts payable" shows as an asset on account of overpayment for printing the Journal.

Following the usual preliminaries of opening the meeting Pres. A. J. R. Curtis delivered the president's annual address, which was full of inspiration and especially interesting in its recounting of the achievements of the Society and the opportunities for future growth and advancement. This was followed by the Secretary's report, which reviewed the progress that the organization had made during the past year. Both the president's address and the Secretary's report are printed elsewhere in this issue.

The reclamation program immediately followed the address of the President and Secretary's report. The program was the same as that contained in the printed program sent to each member prior to the meeting, except that the first number on the program of the afternoon session of the first day was devoted to a paper entitled "Brush Breaking and Brush Plow Designs" by M. E. Jahr of the University of Wisconsin. Following the papers of the afternoon session the reports of the Standards Committee and the Research Committee were presented by E. A. White and R. W. Trullinger, respectively, chairmen of these committees. A paper entitled "Standard Drainage Specifications," though not scheduled on the program, was held over from the afternoon session and delivered at the beginning of the evening session of the first day, by E. V. Willard, commissioner of drainage and waters of Minnesota.

Following the presentation of the paper by Mr. Willard the remainder of the evening session of the first day was devoted to the College Section program. This program was the same as scheduled in the printed program.

The morning session of the second day was devoted to the farm power and equipment program. The afternoon session was given over to the farm structures program. The only change in the printed program was the addition of the paper "Tests on Self-Supporting Barn Roofs," by A. W. Clyde, extension professor of agricultural engineering at Iowa State College to the afternoon program.

The program of the sixteenth annual meeting of the American Society of Agricultural Engineers is the first on which a woman has ever been scheduled to address the Society. Her inspirational and highly instructive paper, "How to Make the Farm House a Home," by Miss Joanna M. Hanson, head of the art department of the Iowa State College, was one of the important features of the meeting.

The evening of the second day was given over to the annual banquet of the Society. The toastmaster for this occasion was Frank A. Meckle, agricultural engineering editor of The Capper Farm Press. It is a fact that the Society should be proud of that it does not have to look outside the organization to find a toastmaster who can handle the situation in the most creditable manner. Frank was no exception to his predecessors.

The principal speakers at the banquet were Dr. W. F. Gephart, vice-president of the First National Bank of St. Louis and dean of the School of Commerce at Washington University, and Hon. Charles M. Hay, a St. Louis attorney. President A. J. R. Curtis and president-elect E. W. Lehmann also made addresses befitting the occasion. Prof. J. B. Davidson, of Iowa State College, whom the toastmaster introduced as the "dean of agricultural engineers," in an impromptu talk pointed out the significant fact that what the agricultural industry needs today is not more people but more engineering and mechanical equipment.

The morning session of the third day was devoted to four section programs going on simultaneously.

The annual business meeting of the Society was called at 11:00 A. M. on the third day of the meeting. Owing to a quite general dissatisfaction as to the time of holding the annual meeting, most of the discussions at the business meeting were given over to an effort to arrive at a more satisfactory time. Action was taken at the meeting instructing the Secretary to canvass the membership of the Society as to its preference as to time and place at which the annual meeting should be held. A number of invitations to hold the annual meeting at various places were received, and it was decided that the canvass of membership should also determine their preference as to the place where the annual meeting should be held this year.

The business meeting was closed by the installation of the officers for 1923. President-elect Lehmann in a brief address outlined the aims and objectives of the new administration which will be given elsewhere in this issue of AGRICULTURAL ENGINEERING.

A resolutions committee consisting of I. W. Dickerson, chairman, S. H. McCrory, and J. B. Davidson presented the following resolutions which were unanimously adopted at the business meeting:

"Whereas the 1922 meeting of the American Society of Agricultural Engineers has been one of the most successful and inspiring the Society has ever held,

"Be it resolved, that the Society extend its thanks and appreciation to the Chairman, Mr. W. H. Stentz, and the other members of the Committee on Local Arrangements for their full cooperation and special efforts in making the arrangements which have contributed so largely to the success of the meeting, to Miss Joanna Hanson for her delightful and instructive paper before the convention and to Hon. Chas. M. Hay and Dr. W. F. Gephart for their thoughtful and inspiring address at the banquet.

"Whereas the place of meeting and hotel arrangements have been unusually satisfactory at this meeting,

"Be it resolved, that the Society extend to the management and employees of the Jefferson Hotel its appreciation of the efficient service and many courtesies extended.

"Whereas some of those preparing papers for our program were prevented from attending because of family illness,

"Be it resolved, that the Society extend its sympathy to them in their affliction.

"Whereas the development of research work is of primary importance to the Society and to maintaining and improving the ideals and standards of American life,

"Be it resolved, that we appreciate and commend the high character of the research work manifested in our papers and discussions at this meeting, and that we urge our members and incoming officers to call to the attention of our agricultural college and experiment station officials the importance of the agricultural engineering work to our farming public and the desirability of liberal and continued support of agricultural engineering research and extension work.

"Whereas it is desirable that the topographic survey of the United States be completed at the earliest possible moment,

"Be it resolved, that the Society urge the early passage of laws necessary to make possible the prompt completion of the topographic surveys."

Reports of A. S. A. E. Student Branches

UNIVERSITY OF ILLINOIS

EARLY in the spring of 1922 several men interested in agricultural engineering formed the Illinois Student Branch of the American Society of Agricultural Engineers, electing F. U. Naughton, president; John C. Ralston, vice-president; and Lee H. Ford, secretary-treasurer. Meetings were held every second and fourth Tuesday in the month, the discussions including such topics as lumbering, drainage, tractor power vs. horse power, home equipment, electric power from transmission lines, and grain cleaning and grading machinery.

At the last meeting of the school year, May 24, 1922, the branch elected the following officers to serve the first semester of 1922-1923: F. L. Victor, president; Lee H.

Ford, vice president; and R. R. Morrison, secretary-treasurer.

The first meeting following the summer vacation was held September 27, at which time Frank P. Hanson, extension specialist in farm mechanics, gave a talk on the activities of the student branches of this Society.

At the October 4 meeting Fred R. Wiley, of the farm mechanics department, gave an interesting talk on radio apparatus. The feature of the October 18 meeting was a talk on the scope of agricultural engineering by R.C.Kelleher, of the farm mechanics department.

The services of the farm mechanics department of the University to the farmer was outlined in a talk by Prof. E. W. Lehmann, head of the department. A significant feature of Prof. Lehmann's talk was along the lines of how leaks on the farm may be stopped by applying engineering principles, with particular reference to the inefficient use of machinery, time lost in doing work because of poorly arranged buildings, loss of crops held in storage, or lowering of quality because of poor buildings, soil erosion, inefficient transportation, etc.

The subject, "Uses of Soy Beans and Methods of Harvesting," was presented at the November 15 meeting by Lee H. Ford. After the business meeting a social hour was enjoyed, ginger-bread and milk featuring.

On December 9 the members of the Student Branch co-operated with the farm mechanics department in staging the annual agricultural college open house. The farm mechanics exhibit included: Farm drainage display; models and blue prints of typical farm buildings; general field machinery; a collection of historic implements; types of binder heads; a demonstration of the soil packer; grain binder in operation; disassembled grain binder; grain drill in operation; mowing machine in operation; demonstration of corn planter in operation, and testing accuracy of drop; home equipment, including light and water supply, sewage disposal, etc.; ignition equipment; farm shop work, including belt lacing, rope tying, and splicing; plumbing, soldering, babbitting, etc.; farm tractor display, demonstration of tractor brake horsepower tests, stationary and tractor engines in operation; demonstration of prony brake test on engines; farm concrete exhibit, demonstration of tracklaying tractor, demonstration of silage cutter in operation; threshing machine in operation, straw spreader in operation.

At the December 13 meeting C. A. Scholl, of the farm mechanics department, gave a talk on "Profits to Farmers by Proper Housing of Farm Machinery."

The student branch now has a bulletin board in the main lobby of the Agricultural Building. Besides the announcements of the branch activities, pictures, and articles of interest will be posted.

IOWA STATE COLLEGE

The Iowa Student Branch of the A. S. A. E. has about forty enrolled members at the present time. Two types of meetings are held by the members—a seminar and open meetings for all members. The seminar meets once a week during a regular class hour and is composed of juniors and seniors only. There are about twenty-five members of the seminar. Members present papers on agricultural engineering or related subjects not covered in the regular courses, which are followed by prepared and open discussions.

The open meetings for all members of the department are held in the evening once in two weeks and a great variety of programs are used. The first meeting of each term is a general mixer or get-acquainted meeting.

Frequently talks by instructors and professors of the department of agricultural engineering, by prominent men of other departments of the college, and by agricultural engineers outside the college form an important part of the program. In connection with these programs educational motion pictures are also used which are furnished by manufacturers or by the visual instruction service of the college extension department. All members of the Iowa branch are taking a very active interest in the meetings, especially the seminar.

UNIVERSITY OF MISSOURI

The A. S. A. E. Student Branch at the University of Missouri elected at the beginning of the school year the following officers: President, Harold T. Barr, secretary-treasurer, James H. Fisher.

The programs given during the first semester consisted of talks and presentations of papers by student members and addresses by men engaged in some phase of agricultural-engineering activities. Some of the subjects covered in these programs include the all-purpose tractor, the Ahart method of plowing, the farm shop, the growth of the tractor industry, the design and construction of the Dodge automobile, history of gasoline, the field for the agricultural engineer, and the agricultural engineer as essential to a basic industry. The Missouri Student Branch has taken an active part in all school activities. A very creditable float was constructed for a "Home Coming" parade.

UNIVERSITY OF NEBRASKA

During the second semester of 1921-1922 regular meetings were held on the second and fourth Thursday of each month. Several outside speakers were present during the term and a real interest was shown in the discussions. An active part was taken by the branch in the annual engineers night and the farmers fair given by the Agricultural College.

Regular bi-monthly meetings have been held during the first semester of the present school year. Much interest has been aroused in the branch activities, and the attendance measurably increased, by a prize competition based upon papers presented at branch meetings on the general subject "Some Agricultural Engineering Problems." The prize consists of a tool chest and set of tools made by students in the division of agricultural engineering.

The officers of the Nebraska branch are: President, J. L. Renner; vice-president, L. C. Haight, secretary-treasurer, Edgar Nichols; and reporter, O. L. Polk.

OHIO STATE UNIVERSITY

The Ohio Student Branch of the Society has been making excellent progress, particularly in membership activities. It has a total membership roll of thirty-five members, most of whom are present at all meetings. At the beginning of the year, however, the prospects were not as bright as might be as most of last year's members were seniors who graduated last June. Those who were left, however, buckled down to work and have accomplished some very outstanding results. They put across the "All Tag Frolic," one of the big events of the year at Ohio State, in a very creditable manner. A new idea that has been started this year is a news letter to former student branch members who have graduated. This letter drew many responses and met with much favor among the alumni.

Minnesota Agricultural Engineers Organize Local Society

THE DIVISION of agricultural engineering at the University of Minnesota has organized a local society of agricultural engineers to which they have given the name of "Agendum," which means "a program of work to be done." This name which is decidedly out of the ordinary also has

another significance, being made up from the first two letters in the first two words and the first letter in the last three words of the name of the division, "Agricultural Engineering Division, University of Minnesota." Some very fine meetings have been held since the organization came into existence. The last three meetings were devoted to such topics as "Experiments with Power Equipment on Peat Lands," "Cement," and "Brush Breaking in Land Clearing work."

Applicants for Membership

The following is a list of applicants for membership received since the publication of the December issue of AGRICULTURAL ENGINEERING. Members of the Society are urged to send pertinent information relative to the applicants for the consideration of the Council prior to election.

G. H. ALFORD, farm machinery editor, "The Progressive Farmer," Dallas, Texas.

GEORGE A. ALTGELT, Guantanamo Sugar Company, Guantanamo, Cuba.

FERRIS DEWEY CORNELL, JR., 151 McLane Avenue, Morgantown, West Virginia.

A. LINCOLN FELLOWS, 301 Customs House, Denver, Col.

JOHN HARRISON HEDGCOCK, Department of Farm Mechanics, University of Illinois, Urbana, Illinois.

CHARLES HAROLD HOPKINS, Woodland, California.

Wanted—Correct Addresses of These A. S. A. E. Members

NOTE: Mail is being returned from the addresses given below. These members, or others who know of their whereabouts, are requested to send the Secretary their correct addresses at once. Inasmuch as delivery cannot now be made, AGRICULTURAL ENGINEERING will not be mailed until correct addresses are received.

Nelson C. Beem, Carey, Ohio.

Claude S. Bristow, Elks Club, Portland, Oregon.

X. Caverno, Kewanee, Illinois.

R. D. Chapman, 1336 Woodward Avenue, Detroit, Michigan.

George Collins, 461 Market Street, San Francisco, California.

George M. Duncomb, 136 S. Harvey Avenue, Oak Park, Illinois.

J. C. Elliff, Box 115, Little Rock, Arkansas.

H. A. Hatfield, Bank of Hamilton, Toronto, Ontario, Canada.

W. R. Killinger, 108 S. Franklin Avenue, Riverside, Illinois.

H. D. Lewis, Box 146, State College Station, North Carolina.

M. W. McDonald, Charleston, West Virginia.

John T. Montgomery, Bliss, Oklahoma.

Arthur H. Pearsoll, 1350 Rosedale Ave., Chicago, Illinois.

Jose Rivera, Matamoros 23, Mexico City, Mexico.

F. K. Runyan, 187 Peachtree St., Atlanta, Georgia.

George W. Rynders, Box 127, Bradley, Illinois.

Lee Stewart, Spooner, Wisconsin.

J. H. Stowell, 3500 Colfax Avenue, South, Minneapolis, Minnesota.

S. Y. Sweeney, 111 East Campbell Avenue, Roanoke, Virginia.

T. A. Toenjes, 1115 South Street, Waterloo, Iowa.

L. R. Van Volkenberg, Box 642, Fargo, North Dakota.

J. C. Weidrich, c/o Dempsey Hotel, Davenport, Iowa.

George G. Whitfield, Demopolis, Alabama.

A. A. Wolf, Y. M. C. A., Omaha, Nebraska.

Book Review

FARM MECHANICS, by Fred B. Crawshaw, formerly professor of manual arts at the University of Wisconsin, and E. W. Lehmann, professor of farm mechanics at the University of Illinois, member of the American Society of Agricultural Engineers, published by the Manual Arts Press, Peoria, Illinois. Price $2.00. This book was prepared primarily for use in vocational agricultural high schools, but it may also be used as a reference book for county agricultural agents and farmers in connection with the solution of many farm-engineering problems. The book is divided into eight distinct parts, the subject matter being covered in forty chapters; the eight parts include the following subjects: Woodworking; cement and concrete; blacksmithing; sheet metal work; farm machinery repair and adjustment; belts and belting; farm home lighting and sanitary equipment; and rope and harness work on the farm. The book is further subdivided into chapters and numbered topics, facilitating the locating of various details and descriptions that are offered. The treatment throughout the book is thoroughly practical. Emphasis is placed upon the proper use of tools and materials in their application to projects. Projects are selected from the standpoint of practical application to the needs of the student. The gradation of the projects within each of the parts has been kept in mind.

EMPLOYMENT SERVICE

This service, conducted by the American Society of Agricultural Engineers, appears regularly in each issue of AGRICULTURAL ENGINEERING. Members of the Society in good standing will be listed in the published notices of the "Men Available" section. Non-members, as well as members, are privileged to use the "Positions Available" section. Copy for notices should be in the Secretary's hands by the 20th of the month preceding date of issue. The form of notice should be such that the initial words indicate the classification. No charge will be made for this service.

The Secretary receives at frequent intervals bulletins from the Engineering Societies' Service Bureau, 29 West 39th Street, New York City, listing the "positions open" as reported by member societies. Copies of these bulletins are sent to the "men available" listed below, as soon as received.

Men Available

MECHANICAL AND ELECTRICAL ENGINEER, graduate of Cornell University and Armour Institute, with nineteen years of practical experience in designing, manufacturing, and marketing gasoline engines, automobiles, motor trucks and tractors, having specialized particularly on internal-combustion motors and their application, prefers mechanical work cooperating with the different manufacturing and sales departments along the lines of sales engineering, or other work into which his qualifications would fit. MA-104

AGRICULTURAL ENGINEER wants position in southwest. Graduate of University of Illinois 1915, five years practical experience on Illinois farm with power equipment, two years in charge of the agricultural engineering department New Mexico College of Agriculture; considerable garage experience and service experience on unit power and light plants. Also one summer in Philadelphia battery service station. MA-106

AGRICULTURAL ENGINEER, graduate in mechanical engineering at Michigan Agricultural College, desires position teaching all kinds of farm machinery or automotive work, or with some farm-equipment manufacturer. Will be available April 1, 1922. Has served one year as instructor in tractors and trucks, and one year conducting service schools for a leading tractor manufacturer. Can furnish best of references. MA-110

AGRICULTURAL ENGINEER, graduating from University of Missouri at the end of present semester (available January 1, 1923), would like position teaching agricultural engineering work or with some company manufacturing farm equipment. Age 23. Unmarried. MA-115

AGRICULTURAL ENGINEER, graduating from University of Illinois at end of present semester (available March 1, 1923) would like position in service department or experimental department of company manufacturing tractors or farm machinery. Three years' practical farm experience in West and one year in Illinois. Age 27. Unmarried. MA-116.

Positions Open

DRAFTSMAN who has had experience in designing and manufacturing threshing machinery with reliable well-established farm-machinery manufacturer in central Pennsylvania. PO-1.

DRAFTSMAN to assist in designing threshing machinery and gas tractors with well established manufacturer of farm machinery in the East. PO-2.

STUDENT FELLOWS OR INSTRUCTOR IN DRAINAGE, the department of soils of the Oregon State Agricultural College will be able to use two student fellows, one in pure soils and one in soil irrigation and drainage work, if they can be promptly located, or an instructor in drainage if fellows are now secured. Write W. L. Powers, chief in soils, Corvallis, Oregon. PO-3.